

Memo to: Ralph Base-Fay and Dick Nelson of USACE

Date, October 5, 2005

From: Doug Albright of Actuation Test Equipment

Subject: Status report, data presentation and delay list.

Dear Ralph and Dick,

I'm currently working on completing the final items on the contract SOW. Left to complete are the Linkable ActiveX/DLL module for the pre-developed code, improved documentation to allow personnel unfamiliar with computers to operate the ITB, and the Data Analysis "PostProcessor" package to create the 2-D cam curves and efficiency profile from the collected data.

At our last conversation I asked what you wanted to take away from this project. This question is still on the table.

ActiveX/DLL Preparation

This method of programming is new to me, so like the OPC communication method (which due to the steep learning curve I refunded all labor charges for the month of March '05) some study has been necessary to prepare myself for this task. Again I've been working on my own time to figure this out, and will be charging only modestly for time spent in this area when contract coverage and funding are resumed.

You've got to pay something for it, but I recognized that my efficiency/effectiveness in this area is somewhat lacking; which is why I've been working on this since my last invoice was submitted (and will continue for some time) without compensation.

I'm finding that ActiveX DLL modules are somewhat complex to create. Additional time will be necessary; first to make this work correctly, and then to test for robust and stable performance, but I'll get there. As with all programming efforts, the first pass is to make it do what you want, the second to prevent it from doing things you don't want it to do. The last parts are to document how it works and prepare the deliverables. Failure modes analysis and prevention/error handling is difficult and tedious when there are so many unknowns. Delivering items that are not adequately completed to satisfy milestone timing requirements is necessary, but should acknowledge this is still a "work in progress."

Improved Documentation

Documentation is always the last item to be done and often suffers because of it. The ITB software, like all other ATECo software products depends heavily on embedded Help files to provide documentation for the end user, at the time when it's needed most.

The ITB Help system has been hampered on several occasions by the OPC Test Unit Perturbation function's persistent need to take Focus away from other ITB software functions. I believe this part is working satisfactorily now.

These help files can be edited at the ITB at any time as new things are observed, learned or recognized. Again, the Help files will always be a work in progress. As these become more complete and elaborate as time progresses, the latest, most complete set of Help files will be posted on the ITB WebSite for free download into an ITB at any time.

Data Analysis Package

This has been started and is well under way. Many items in the PostProcessor were in the original ITB software package that was brought to the table by ATECo before the contract was signed. (See Screen Gallery and Software Report from October '03) Removal of all graphical data displays was directed by HDC for unknown reasons before the ITB field test in September 05, but much of this capability has now being restored to the ITB for analysis of Test Unit performance as the PostProcessor package. (See Appendix I, PostProcessor output.)

Delays, Added tasks and Red Herrings

Over the course of this work, many added tasks and red herrings inflicted by HDC have consumed project time and money (Appendix II), which displaced some of the planned/budgeted items that unfortunately did not get done to everyone's satisfaction within the time period and funding of the contract.

As this is a "time and material" contract, I have had no say in what items were added, but CE has a contractual obligation to pay for items added after the contract is signed.

OPC Communication and Perturbation

The September '05 test at McNary was successful demonstration of the application of OPC technology in the ITB and the Perturbation function to provide "Off-Cam" data for analysis.

Data Analysis Method

As I see it, the "big-picture" items are to improve turbine efficiency and reduce water turbulence to reduce fish mortality. From the initial look at the data with the PostProcessor, much improvement can be made to unit performance using the ITB output data for reference (Appendix III)

Data from 4 sources is being evaluated to derive the analysis

1. The ITB field-test data
2. 3-D cam profile data from Calvin Hsieh, Units 2, 5 & 9.
3. 3-D cam profile from Dan Watson Unit 5.
4. Cam data from Rod Wittinger et al from Water Power 99, Unit 5.

From this data we can see a problem with the 3-D cam data map and Blade positioning performance that must be corrected before the ITB can derive a satisfactory efficiency profile for Unit #5. The ITB has limited ± 2 -degree authority on Blade position, but the Blades are only within 2 degrees of the prescribed-On Cam position in the Hill Curves for a small portion of the Unit's operating envelope. The data will be satisfactory to

demonstrate ITB performance, but not to derive an adequate Efficiency Profile and Cam Curve prescribed by the Contract.

For the purpose of this discussion, this inventory can be accomplished by functions. The following inventory will aid in our discussions:

SteadyState Function. This was fully developed prior to signing the contract and is included in the Copyrighted Linkable-Module portion of the program. Please refer to the attached Software Report and Screen Gallery for details. These documents were prepared to record the state of software development prior to the start of the contract period as part of a larger set of documenting ITB hardware, software and methodology development.

Copies of this full set of documents (>25MB) were sent to Lee Sheldon, Rod Wittinger, George Williams, Dave Ebner, my lawyer and mentor during contract negotiations to show how far development had progressed.

Some modifications were necessary to adapt this software to the GDACS OPC data stream and hardware. All graphing routines except Blade vs. Gate and Efficiency vs. Gate, were removed at CE direction prior to ITB deployment, and then these two were removed immediately after receipt of the ITB at HDC at CE direction. Now some of them are being restored to the ITB to facilitate the PostProcessor data reduction.

FOIA Request is for the software and manuals for the 3-D cam so I may ascertain the true nature of its control algorithm. In order to fully understand and demonstrate the ITB's performance, it would be helpful to know the nature of the Test Unit's control mechanism to explain what we're seeing in the ITB output data.

In conversation and an email on August 31, 2004, Dan Perrier told me that the original 3-D cam by Rod Hurst was not really a 3-D cam; instead it was only a 2-D Head-Bias on Blade position controller. If the Hill Curves are parallel straight lines, this would be OK, but they are usually not. Most turbine Hill curves I've seen have some divergence at the top where the highest power is, and thus the tightest accuracy is needed. I've asked the question many times, and never gotten an answer: Is the current version of the SoftPLC GDACS 3-D cam a fully functional Head-Gate-Blade position 3-D cam, or is it still just a Head Bias on Blades controller? If the ITB is to be truly successful, it makes a difference.

From the FOIA requested information I will be able to learn whether it is a fully functional Head-Gate-Blade 3-D cam, or just a Head-Bias on Blade controller.

Data from Unit5 Field Test

From the attached graphs, it can be seen that there is a gross misalignment of the mechanical cam follower on the Gate Restoring system. This data was taken in the GDACS 3-D cam "Manual Mode," so this is a direct indication of the 2-D cam's profile without any corrective action from the GDACS 3-D cam.

It is believed that this misalignment will cause the noisy operation reported, leading to lost revenue due to compromised efficiency and increased turbulence in the water passages that will have an adverse effect on fish mortality.

If the 3-D cam is just a Head-Bias on Blades, it will not correct the slope error in the 2-D cam profile; it will just provide an offset, or parallel gate-blade curve to the 2-D cam's profile slope.

If the 3-D cam is truly a fully functional 3-D cam, it will be able to correct to the Hill Curves within the limits authority of the 3-D cam's blade positioner.

In this case however, the slope error is so great the limited authority of the 3-D cam cannot correct to the Hill Curve's On-Cam line over the full operating range of the unit. If the GDACS has a fully functional 3-D cam, the Units' performance would be able to hit the Hill Curves in the central area of the operating envelope, wherever the On-Cam position minus the Cam Follower position is within the 3-D cam's limited range of authority.

If it is a Head-Bias on Blade controller, the blade position would not be corrected to the On-Cam position, it would just have a fixed offset on Blades relative to head.

Appendix I.

**List of items added to SOW after contract was signed and delays encountered:
Start date, 25 May, 2004, this list prepared on October 5, 2005**

1. 25 May, 2004 - Delay due to insurance problems. Could not start until I got proper coverage. It took three weeks to figure out that Illinois carriers didn't understand the requirement due to Illinois laws. Finally bought insurance from an agent in Portland.
2. Delay due to IBM backordered the computers, then canceled the order to get out of the sale price they had agreed to. Reordered on 6-21-04, received on 7-14-04.
3. July 8 2004, waiting for GDACS Committee to decide how ITB is to connect to GDACS. Answer was "no you can't." Spent several weeks researching virus susceptibility of SoftPLC computer, and how to get around it with hardware and software methods to get one-way communication using modified RS-232 and fiber optic hardware. No satisfactory method ever found.
4. August 2004, several weeks delay resulted from 3-D cam hardware unavailability and uncertainty of what 3-D cam hardware would eventually be used. When I went to HDC in late August, mysteriously a Seawell cam had been installed on Unit #5 in place of the SoftPLC that was supposed to be there.
5. October 14 2004 Due to lack of cooperation and difficulty identifying the Test Unit Blade position control hardware to be used, A Stop-Work order was issued by the COR. This was in place until October 25, 2004, when the GDACS interface ultimately used was agreed to by the GDACS Committee.

6. September 2004, more delay resulted from waiting for HDC to order the TopDoc program from SoftPLC, then setting up and learning how to use the SoftPLC TopDoc program to edit the SoftPLC 3-D cam C-code programming in the Stand-Alone 3-D cam. We ultimately learned there's no C-code in the SoftPLC to edit.
7. The test simulation/Bench Test was planned using the 3-D cam MockUp at HDC. Shortly after the contract period started, we learned it was missing, later found in the back room at ACSI. We were told it would be repaired and made available, but it was not. We were told analog input modules from it would be available for test simulation/Bench Test work, but when this was needed it was denied. Alternate test simulation methods had to be developed by ATECo.
8. October 2004, was directed to use OPC communication method, but no information or training was offered except to subcontract software development to ACSI. Rod said avoid ACSI, which I did.
9. ACSI recommended, and HDC directed that RSLinx OEM be purchased for the OPC interface. HDC was to loan the Visual Basic support portion of their RSLinx SDK package. When this was needed, it was denied. RSLinx SDK was purchased from Rockwell by ATECo.
10. On September 9, 2004 HDC started discussing helping to get assistance with OPC communication from ACSI on a Task Order, but with HCD oversight. The Task Order was in place in May 2005, but this assistance was excluded.
11. HDC refused to provide any assistance or information on the required GDACS communication interface, ie, data tag names for the signals needed for the ITB.
12. After a couple of months of struggling with Rockwell RSLinx OPC Visual Basic support (despite ACSI and HDC direction to use that specific product) we switched to Software Toolbox's OPC server and purchased the tag name information (which was freely available at Ed's fingertips) from ACSI for \$1,000.
13. HCD directed the ITB be delivered in April, 2005 without the Perturbation function in it. Immediately upon receipt of the ITB HDC directed the Perturbation function be written by ATECo to be installed in the ITB and checked out by HDC and ACSI under their Task Order.
14. When trouble was encountered with the Perturbation function, HDC refused to provide detailed information on the problem or run diagnostic procedures prepared and provided by ATECo (as had been agreed to), instead a clumsy fix was applied to the Relay Ladder Code in the SoftPLC and the true nature of the problem was withheld. Several weeks of struggle were necessary to get the diagnostic information and fix the "Zero Problem."
15. When the contract time interval expired, a surprise modification was snuck into the Contract while it was being modified at HDC without the knowledge of the COR or myself. Several weeks' delay ensued while this was corrected.
16. October 5, 2005 Rockwell RSLinx OEM and SDK software purchase price refund by Rockwell Software.
17. March 2005, Automatic Winter Kennedy flushing valves were included in the original proposals for the ITB, but were removed by HDC during contract negotiations. When the frequent need for flushing became known, this feature was added back into the SOW without restoring the time and material that had been negotiated out when it was removed.

18. Multi-point Winter Kenney transducer calibration verification routine was not in the SOW or mentioned by the POC at any time. This was not added to the SOW until after the first field test at McNary, and was not added to the ITB until last week. A new executable was sent to HDC last week with this feature included. This item was added to ITB by ATECo without compensation.
19. A transducer cart was proposed by ATECo for the Winter Kennedy system, but was rejected by HDC as “overkill.” After the field test experience in September HDC wanted it. This cart is currently being developed and constructed by ATECo without compensation.